REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 10-23 will be pending in the application subsequent to entry of this Amendment.

As a preliminary matter, on the Office Action Summary Sheet, item 7, it is indicated that claim 7 is objected to. According to my telephone discussions with Examiner Bolden on March 30, 2005, there is no objection directed to claim 7. Further, on the same date, counsel was informed that item 10, the drawings filed on June 30, 2003 have been accepted. That is, in item 10, the box a) should have been checked.

Page 22 of the specification has been amended as kindly suggested by the examiner on page 2 of the Official Action.

Discussion of New Claims

The previous claims have been amended and adjusted in order to more particularly point out and distinctly claim that which applicants regard as their invention and to emphasize certain preferred embodiments in the invention. A synopsis of the amendments made to the claims is provided below, including, where appropriate, basis in the original description of the invention for these changes.

Claim 10 is similar to claim 1 with the glass transition temperature (Tg) limited to 550°C or lower as disclosed in the first paragraph of [0018].

Claim 11, similar to claim 2, is dependent upon claim 10 with the glass transition temperature (Tg) reduced by 10°C and limited to 540°C or lower as disclosed in the first paragraph of [0018].

Claim 12 is dependent upon claim 10 and defines six glass components as described in the second paragraph of [0018].

Claim 13 is dependent upon claim 10 and defines those glass components and contents which are specified in original claim 4.

Claim 14 is dependent upon claim 11 and defines those glass components and contents which are specified in original claim 4.

Claim 15 is an independent claim specifying that the claimed optical glass consists of B_2O_3, SiO_2, Li_2O, CaO, ZnO, La_2O_3, Gd_2O_3, Y_2O_3, Al_2O_3 and ZrO_2 and does not contain BaO.

The absence of BaO is disclosed in [0033] where ZrO_2 is 0 to 3%. Claim 15 includes an embodiment in which the content of ZrO_2 is 0% as disclosed in [0033] of the specification.

Claim 15 thus corresponds to amended claim 4.

Claim 16 is dependent upon claim 15 and specifies that the optical glass comprises a refining agent as described in [0034].

Claim 17 is dependent upon claim 15 and, as in original claim 1, specifies that the glass transition temperature (Tg) is 550°C or lower and that the haze value is 3 % or less.

Claim 18 is dependent upon claim 15 and specifies that the glass transition temperature (Tg) is 540°C or lower as in claim 11 and that the haze value is 3 % or less as in claim 10.

Claim 19 corresponds to original claim 5 and is directed to a press-molding perform.

Claim 20 corresponds to original claim 6 and is directed to an optical element.

Claim 21 corresponds to original claim 7 and is directed to a process for producing a perform for press-molding.

Claim 22 corresponds to original claim 8 and is directed to a process for producing an optical element.

Claim 23 corresponds to original claim 9 and is directed to a process for producing an optical element.

Important Characteristics of the Invention

As described in applicants' specification, section [0002], conventional optical glasses having optical constants such as a refractive index (nd) of 1.57 to 1.67 and an Abbe's number (vd) of 55 to 65 are useful as a material for optical elements. However, these conventional glasses have a glass transition temperature (Tg) of over 560°C, and when such glasses are used, there is a problem that since a high molding temperature is required, the surface of a press mold is deteriorated.

As specified in new claim 10, the present invention provides an optical glass that has a glass transition temperature (Tg) of 550°C or lower and that is suitable for press-molding. When the glass transition temperature increases by 10°C, the temperature for precision press-molding also increases by 10°C as well. In this case, the reactivity of the glass and a press mold is approximately doubled, and thermal melt sticking of the glass and the press mold to each other is liable to take place. Further, it takes a longer time to increase the glass temperature to a suitable

press-molding temperature or to decrease the temperature of the press-molded product (glass), so that the productivity of optical elements is decreased. Therefore, the idea of decreasing the glass transition temperature by 10°C is technically significant as far as an optical glass to be used for precision press-molding is concerned.

As specified in new claim 10, further, the present invention provides an optical glass having a haze value of 3% or less and exhibiting excellent climate resistance while having a glass transition temperature (Tg) of 550°C or lower.

When a glass has a refractive index in the range of 1.57 to 1.67 and an Abbe's number in the range of 55 to 65 as specified in new claim 10, the problem was that it was difficult to prepare a glass having excellent climate resistance. Further, there was another problem that when the glass transition temperature is decreased, the glass is degraded in climate resistance. It is advantageous for precision press-molding to decrease the glass transition temperature as described above. However, this decrease is achieved as a trade off for degradation of the glass's climate resistance. And, when a surface of a glass (perform) before press-molding is deteriorated, and an altered layer called a burnt layer is generated, it follows that this altered layer remains in the surface of the optical element obtained by precision press-molding.

The present invention overcomes the fundamental problem of a precision press-molding glass having a refractive index in the above range and an Abbe's number in the above range and provides a novel optical glass having a glass transition temperature of 550°C or lower and a haze value of 3 % or less.

The Official Action includes six prior art-based rejections each based upon one of three separate documents. Applicants respond to these rejections upon analyzing the subject matter defined in the new claims presented above, experimental evidence provided by the senior inventor and presented in the attached evidentiary declaration of inventor Kasuga made August 29, 2005 and pointing out the significant deficiencies of each of the applied references.

Comparison between the present invention and the Onozawa reference

Onozawa reference fails to disclose the problem of the present invention (when the glass transition temperature is decreased, the climate resistance is decreased, and that a low glass transition temperature and excellent climate resistance are not consistent with each other). Further, Onozawa reference does not have any idea of how to prepare a glass having improved

climate resistance by introducing a quantitative index such as a haze value like the present invention.

Attached to this response are three tables. Table 1 shows mol% conversion of the results of the glasses that are specifically disclosed in Onozawa reference, that is, glasses of Examples 1 to 15. None of the glasses of Examples of Onozawa reference described in Table 1 come under the glass composition recited in new claim 13.

For demonstrating that Onozawa reference neither discloses the composition nor discloses the glass properties described in new claim 10, Ms. Yoshiko Kasuga, the first named inventor, has carried out a duplicate experiment of a specific Example of Onozawa reference to and summarizes the results of her studies in the attached Evidentiary Declaration. The duplicate experiment has been carried out with regard to the glass of Example 6 of Examples 1 to 15 of Onozawa reference, which glass of Example 6 has a refractive index of 1.667, an Abbe's number of 58.3 and a glass transition temperature of 519°C and appears to be formally near (this does not mean "technically near") to the glass composition specified in new claim 13. As a result of these studies, it has been found that the glass has a haze value of 4.10 % and is hence poor in climate resistance as compared with the glass specified in new claim 10. Onozawa reference also describes a glass in Example 9 which appears to be formally near to the present invention. However, this glass has a glass transition temperature of 556°C, which is outside the corresponding range as defined by the claims of the present application.

As explained above, Examples 6 and 9 that are representative of and specifically disclosed in the Onozawa reference and appear to be formally near to the present invention are not capable of achieving applicants' consistency of low glass transition temperature and excellent climate resistance, so that it is also clear that the Onozawa reference does not overcome the problem solved by the present invention.

Further, the Onozawa reference provides no guideline or hint of how to decrease the glass transition temperature to 550°C or lower while maintaining the haze value of 3.0 % or less, so that it is not obvious for one skilled in the art how the glass compositions of the Examples in the Onozawa reference can be changed to arrive at the glass of the present invention.

As explained above, the inventions of independent claim 10 and claims 11 to 14 dependent thereon differ from the disclosure of the Onozawa reference, and they are not obvious over the Onozawa reference.

In new independent claim 15, the optical glass consists of only B_2O_3, SiO_2, Li_2O, CaO, ZnO, La_2O_3, Gd_2O_3, Y_2O_3, Al_2O_3 and ZrO_2, and does not contain Ta_2O_5. Onozawa is directed to a glass containing Ta_2O_5 as an essential component, so that the inventions of new claim 15 and claims 16 to 18 dependent thereon, which do not contain Ta_2O_5 essential in Onozawa reference and overcome the different problem, are novel and unobvious.

Comparison between the present invention and the Nishimoto reference

Nishimoto reference teaches that to provide a glass for mold press-forming it is necessary to have a low softening point and high climate resistance. However, the Nishimoto reference neither discloses that the above two properties have a trade-off relationship, nor that it discloses that a quantitative index such as a haze value is introduced for materializing a glass having higher climate resistance.

Table 2 also attached to this response shows mol% conversion results of various representative glass compositions specifically disclosed in the Nishimoto reference, that is, glass compositions of Example 1 to 12. Of these glass compositions, the glass compositions of Examples 2, 3, 7 and 8 appear to be formally near to the present invention. Applicants consider that the glass compositions of Examples 2 and 3 have properties similar to the properties of the glass compositions of Examples 8 and 7. The attached declaration by Ms. Kasuga (the first-listed inventor herein) has selected Examples 7 and 8 of Nishimoto reference and has carried out duplicate experiments which show that even Examples 7 and 8 are inferior to the present invention in climate resistance. As described in her Declaration, the results show that the glass of Example 7 has a haze value of 8.93 % and that the glass of Example 8 has a haze value of a remarkable 36.83 %, which are far larger than a haze value of 3.0 % or less of the glass recited in new claim 10.

Further, the Nishimoto reference includes no hint or suggestion of how to decrease the glass transition temperature to 550°C or lower while maintaining a haze value of 3.0 % or less, so that it is not obvious for one skilled in the art how the glass compositions of Examples in the Nishimoto reference can be changed to obtain a glass as recited in new claim 10.

As explained above, the inventions of independent claim 10 and claims 11 to 14 dependent thereon differ from the invention of the Nishimoto reference, and they are not obvious over the disclosures of the Nishimoto reference.

In new independent claim 15, the optical glass consists of only B_2O_3, SiO_2, Li_2O, CaO, ZnO, La_2O_3, Gd_2O_3, Y_2O_3, Al_2O_3 and ZrO_2 – it and does not contain BaO. BaO is a component that decreases the climate resistance and increases the haze value although it differs depending upon components other than BaO. The invention of new independent claim 15 can provide improved climate resistance without containing BaO as an essential component. Since Nishimoto reference does not describe any composition of new independent claim 15, the inventions of the new independent claim 15 and claims 16 to 18 dependent thereon are novel, and since the Nishimoto reference does not describe any suggestion leading to the inventions of these claims, the inventions of the new independent claim 15 and claims 16 to 18 dependent thereon are unobvious.

Comparison between the present invention and the Hirota reference

Hirota reference discloses nothing concerning a trade-off relationship between glass transition temperature and climate resistance or concerning preparing a glass having higher climate resistance by introducing a quantitative index such as a haze value.

The attached Table 3 shows mol% conversion results of glass compositions specifically disclosed in the Hirota reference; that is, glass compositions of Examples 1 to 11 and Comparative Examples 21 to 23. Of these glass compositions, the glass compositions of Examples 8 and 11 appear to be formally near to the present invention. For purposes of comparison Ms. Kasuga has selected Examples 8 and 11 of Hirota reference and has carried out duplicate experiments show that even Examples 8 and 11 are inferior to the present invention in climate resistance. As described in her Declaration, the results are that the glass of Example 8 has a haze value of 15.08 % and that the glass of Example 11 has an even greater (nearly twice) haze value of 28.78 %, which are far larger than a haze value of 3.0 % or less of the glass recited in new claim 10 has.

Further, the Hirota reference contains no suggestion or incentive for decreasing the glass transition temperature to 550°C or lower while maintaining the haze value of 3.0 % or less, so

that it is not obvious for one skilled in the art how the glass compositions of Examples of the Hirota reference can be changed to obtain a glass recited in new claim 10.

Like the Onozawa reference and the Nishimoto reference, the Hirota reference discloses nothing concerning the composition of new independent claim 15 nor any guideposts leading to the above composition, the inventions of the new independent claim 15 and claims 16 to 18 dependent thereon are unobvious.

For the above reasons it is respectfully submitted that the claims of this application define inventive subject matter. Reconsideration and allowance are solicited.

Respectfully submitted,

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Table 1 Examples of Onozawa Reference

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Component	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%
SiO2	15.8919	13.82326	18.5574	17.59218	18.49086	20.30375	21.42858	22.50635	22.1919	23.54742	24.05048	26.58615	26.40852	26.62853	22.46826
B2O3	38.4237	38.19668	40.06104	30.3819	29.65293	40.90894	28.37235	32.79549	37.12799	34.08823	28.09752	30.60973	33.06566	26.44297	32.38432
Li2O	11.21766	11.15138	7.797116	23.65302	7.991136	13.64939	10.0839	9.929133	8.391778	8.380576	7.133015	11.9152	6.657516	17.45375	9.918527
CaO	17.02502	22.21331	13.25371	7.852719	28.29897	14.50095	18.36517	16.57637	13.37299	23.74248	7.578034	8.702765	18.38946	11.41087	17.01026
SrO	0	0	1.79424	0	3.831014	0	2.486212	4.080091	5.632319	0	16.4142	11.9957	0.766	7.723817	4.075732
BaO	2.497002	0	0	11.51732	4.928737	0	6.733897	4.420365	1.089651	0	0	0	0	1.568995	4.415643
ZnO	0	0	5.13805	0	0.487584	0	3.16427	0	2.048116	0.920422	10.4454	0	7.799272	0	0
ZrO2	1.783066	5.394661	0	0	0	2.112996	1.742232	1.646873	3.044744	0	0.345071	0	0	0.519602	1.71366
Y2O3	5.075837	4.783043	6.174156	3.316713	3.515439	2.882209	3.42212	3.743998	2.215013	2.580732	1.882762	3.931276	1.757254	4.252546	3.739999
Gd2O3	0	0.229497	1.026979	2.433909	0	1.123624	0.711524	0	0	0.689893	0	2.206944	0	0	0
La2O3	5.85953	3.822597	5.987037	2.702684	2.434927	3.743114	2.897022	3.889853	4.602607	5.36254	2.608145	3.539837	4.868564	3.681844	3.885698
La+Gd+Y	10.93537	8.835137	13.18817	8.453306	5.950366	7.748947	7.030666	7.633851	6.81762	8.633165	4.490907	9.678057	6.625818	7.93439	7.625697
Ta2O5	2.160867	0.357122	0.210275	0.398677	0.34122	0.552152	0.563316	0.382532	0.28289	0.659196	1.154193	0.481999	0.233405	0.289661	0.382123
Sb2O3	0.065418	0.028451	0	0.150869	0.027184	0.222878	0.029403	0.028952	0	0.028509	0.291183	0.0304	0.054355	0.027404	0.005784
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
nd	1.721	1.705	1.699	1.66	1.667	1.667	1.702	1.667	1.675	1.683	1.684	1.7	1.663	1.664	1.677
ν d	51.8	52.2	56.2	54.6	58.3	58.3	50.8	55.1	55.4	56.3	52.9	53.8	56.9	55.9	54.9
Tg	546	519	559	480	531	519	538	550	556	568	572	507	579	498	550

Table 2 Examples of Hirota Reference

	1	2	3	4	5	6	7	8	9	10	11	21	22	23
Component	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%
SiO2	44.02919	42.00956	44.60014	43.38357	36.19409	43.15524	39.15246	39.62606	41.57585	53.96093	41.59864	49.32997	49.59072	47.49272
B2O3	22.83179	22.21751	21.92398	21.31982	18.88599	21.42228	23.57557	23.79581	22.79427	11.35274	22.56796	21.08213	21.19357	20.92359
Al2O3	3.431573	3.756506	3.706876	3.048077	3.193217	4.147306	4.997195	2.962982	3.240363	2.155568	3.529009	3.688578	3.708075	4.283182
Li2O	18.79304	21.3532	18.80538	21.34026	18.15128	20.47872	20.61911	14.19845	18.855	16.83133	17.56969	12.62533	12.69207	12.95016
K2O	0	0	0	0	0	0	0	0	0	1.094088	0	0	0	0
CaO	0	0	0	0	22.91237	0	0	18.85534	5.891568	0	8.516287	0	0	0
SrO	0	0	0	0	0	0	0	0	0	0	0	0	0	9.62889
BaO	9.837176	9.88419	10.19391	9.929341	0	9.835688	11.18094	0	6.955978	9.789871	5.38976	12.49198	12.11304	4.045227
ZnO	0	0	0	0	0	0	0	0	0	4.220438	0	0	0	0
La2O3	1.073682	0.77657	0.76631	0.975368	0.660123	0.957263	0.471204	0.556241	0.608313	0.421526	0.823107	0.692457	0.696117	0.670068
Sb2O3	0	0	0	0	0	0	0	0.00207	0.045276	0	0.002241	0.051539	0.002591	0.002494
As2O3	0.003536	0.003456	0.00341	0.003569	0.002937	0.003502	0.003526	0.003053	0.033386	0.173507	0.003305	0.038004	0.00382	0.003677
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 3 Examples of Nishimoto Reference

	1	2	3	4	5	6	7	8	9	10	11	12
Component	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%
SiO2	19.22887	26.47567	26.87203	36.37614	30.91998	25.84088	30.52706	24.58049	27.21449	42.75467	51.13573	26.01063
B2O3	40.95712	29.39386	34.25374	25.41739	27.81206	32.88342	33.4573	27.59301	36.15364	26.85011	20.58258	29.9471
Al2O3	2.26599	1.485703	2.261917	2.272091	1.897764	2.404082	2.767235	2.172481	2.31277	2.290157	2.217566	2.18941
Li2O	17.3219	19.57837	17.29076	17.36853	13.51106	18.37751	15.86517	16.60709	17.6795	12.28077	9.361403	21.73247
Na2O	0	2.444221	0	0	0	0	1.138137	2.382721	0	0	2.432169	0
K2O	0	1.608723	0	0	0	0	0	0.784123	0	0	0.800395	1.580466
MgO	0	0	0	1.916901	0	0	0	1.832863	0	0	0	1.847145
CaO	8.239964	6.753195	6.854294	4.819587	11.04154	7.285098	6.28917	10.53324	4.205036	5.551895	2.687959	5.307661
SrO	0	0	0	3.355501	0	0	0.681124	1.782441	0	2.254787	0	0.718532
BaO	3.02132	3.46664	3.518538	2.524545	4.048563	2.671202	3.22844	4.344963	2.31277	2.544618	2.463962	2.919214
ZnO	3.78593	3.723383	3.779124	0	5.70728	3.012486	3.467542	3.629699	3.864087	0	3.705024	2.743487
ZrO2	0	0	0	0.188111	0	0	0	0	0.127653	0	0	0
Gd2O3	0.851311	1.046559	0.849781	0.426802	0	0.677393	0.779718	0.204045	0.868886	0.86039	0.20828	0.822541
La2O3	4.301211	3.997725	4.293479	5.142174	5.035245	6.819924	1.774935	3.443983	5.234238	4.585933	3.746734	4.15585
La+Gd	5.152522	5.044284	5.14326	5.568976	5.035245	7.497317	2.554653	3.648028	6.103124	5.446323	3.955014	4.978391
Ta2O5	0	0	0	0	0	0	0	0.083557	0	0	0.170582	0
Sb2O3	0.026385	0.025949	0.026337	0.026456	0.026517	0.027993	0.024166	0.025296	0.02693	0.026666	0.025821	0.025493
Bi2O3	0	0	0	0.165775	0	0	0	0	0	0	0.161797	0
Total	100	100	100	100	100	100	100	100	100	100	100	100